

## **Abstract**

The present invention relates to improved catalyst compositions, as well as methods of making and using such compositions to prepare synthesis gas and ultimately C<sub>5+</sub> hydrocarbons. In particular, preferred embodiments of the present invention comprise catalyst systems comprising a core and an outer region disposed on said core, wherein a substantial amount of the catalytic metal is located in the outer region of the catalyst support matrix. In addition, the catalyst systems are able to maintain high conversion and selectivity values with very low catalytically active metal loadings. The catalyst systems are appropriate for improved syngas, oxidative dehydrogenation and other partial oxidation reactions, including improved reaction schemes for the conversion of hydrocarbon gas to C<sub>5+</sub> hydrocarbons.